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NEBRASKA TRACTOR TEST 1110 JOHN DEERE 4430 QUAD -RANGE DIESEL

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NEBRASKA TRACTOR TEST 1110 – JOHN DEERE 4430 QUAD-RANGE DIESEL

Department of Agricultural Engineering
 Dates of Test: October 5 to October 13th, 1972
 Manufacturer: JOHN DEERE WATERLOO
 TRACTOR WORKS, WATERLOO, IOWA

FUEL, OIL AND TIME Fuel No 2 Diesel Cetane No 54.5 (rating taken from company's typical inspection data) Specific gravity converted to 60°/60° 0.8342 Weight per gallon 6.946 Oil SAE 30 API service classification John Deere Torq-Guard or CD-SD To Motor 4.023 gal Drained from motor 3.735 gal Transmission and final drive lubricant John Deere Special 303 Oil Total time engine was operated 41 hours

ENGINE Make John Deere Diesel Type 6 cylinder vertical with turbo-charger Serial No 6404TR-09 34145OR Crankshaft Mounted length-wise Rated rpm 2200 Bore and stroke 4.25" x 4.75" Compression ratio 14.7 to 1 Displacement 404 cu in Cranking system 12 volt electrical (two 6 volt batteries) Lubrication pressure Air cleaner pre-cleaner and two dry type in series with replaceable treated paper elements Oil filter full flow with replaceable paper cartridge Oil Cooler engine coolant heat exchanger for crankcase oil and radiator for transmission and hydraulic system Fuel filter sediment bowl with screen and replaceable paper primary and secondary filter elements Muffler was used Cooling medium temperature control thermostat

CHASSIS Type standard Serial No 4430H-003931 Tread width rear 60.0" to 90.1" front 48.0" to 68.0" Wheel base 106.7" Center of gravity (without operator or ballast, with minimum tread, with fuel tank filled and tractor serviced for operation) Horizontal distance forward from center-line of rear wheels 33.4" Vertical distance above roadway 41.5" Horizontal distance from center of rear wheel tread 0.5" to the left Hydraulic control system direct engine drive Transmission selective gear fixed ratio with partial range synchro-mesh and power shift Advertised speeds mph first 2.0 second 2.6 third 3.4 fourth 4.3 fifth 4.7 sixth 5.5 seventh 5.9 eighth 7.0 ninth 7.7 tenth 8.5 eleventh 9.1 twelfth 9.8 thirteenth 10.8 fourteenth 11.6 fifteenth 14.0 sixteenth 17.8 reverse 3.2, 4.1, 7.5, 8.8, 11.2 Clutch wet multiple disc operated hydraulically Brakes wet disc hydraulically power actuated by two foot pedals that can be locked together Steering hydrostatic Turning radius (on concrete surface with brake applied) right 146" left 146" (on concrete surface without brake) right 158" left 158" Turning space diameter (on concrete surface with brake applied) right 292" left 292" (on concrete surface without brake) right 316" left 316" Power take-off 540 or 1002 rpm at 2200 engine rpm.

REPAIRS AND ADJUSTMENTS: No repairs or adjustments.

REMARKS: All test results were determined from observed data obtained in accordance with SAE and ASAE test code or official Nebraska test procedure. First and second gears were not run as it was necessary to limit the pull in third gear to avoid excessive slippage. Fourth, tenth, eleventh, twelfth, thirteenth, fourteenth, fifteenth and sixteenth gears were not run as test procedure requires only six travel speeds. During maximum drawbar run in 3rd gear the transmission came out of gear twice making it necessary to hold the shift lever in place to complete the run.

We, the undersigned, certify that this is a true and correct report of official Tractor Test 1110.
 L. F. LARSEN

Engineer-In-Charge

G. W. STEINBRUEGGE, Chairman

W. E. SPLINTER

D. E. LANE

Board of Tractor Test Engineers

POWER TAKE-OFF PERFORMANCE

Hp	Crank- shaft speed rpm	Fuel Consumption Gal per hr	Lb per hp-hr	Hp-hr per gal	Temperature Cooling medium	Degrees F Air wet bulb	Air dry bulb	Barometer inches of Mercury
MAXIMUM POWER AND FUEL CONSUMPTION								
Rated Engine Speed—Two Hours (PTO Speed—1002 rpm)								
125.88	2200	8.090	0.446	15.56	189	61	75	29.133
VARYING POWER AND FUEL CONSUMPTION—TWO HOURS								
111.41	2293	7.640	0.476	14.58	186	62	76	.....
0.00	2392	2.747	.....	.....	178	60	73	.....
56.75	2335	5.096	0.624	11.14	183	61	74	.....
127.22	2200	8.206	0.448	15.50	191	61	75	.....
28.64	2357	3.943	0.956	7.26	179	61	75	.....
84.36	2316	6.396	0.527	13.19	187	61	75	.....
Av 68.06	2315	5.612	0.579	12.13	184	61	75	29.127

DRAWBAR PERFORMANCE

Hp	Draw- bar pull lbs	Speed miles per hr	Crank- shaft speed rpm	Slip of drivers %	Fuel Consumption Gal per hr	Lb per hp-hr	Hp-hr per gal	Temp Cool- ing med	Degrees F Air wet bulb	Air dry bulb	Barometer inches of Mercury
VARYING DRAWBAR POWER AND FUEL CONSUMPTION WITH BALLAST											
Maximum Available Power—Two Hours—7th Gear (B2)											
104.99	7211	5.46	2196	7.07	8.116	0.536	12.94	187	59	77	28.790
75% of Pull at Maximum Power—Ten Hours—7th Gear (B2)											
87.70	5578	5.90	2314	4.69	7.331	0.580	11.96	182	62	70	28.895
50% of Pull at Maximum Power—Two Hours—7th Gear (B2)											
60.76	3738	6.10	2357	3.36	5.975	0.682	10.17	182	46	54	29.080
50% of Pull at Reduced Engine Speed—Two Hours—8th Gear (C2)											
61.06	3760	6.09	1985	3.31	5.020	0.571	12.16	178	54	66	29.045

MAXIMUM POWER WITH BALLAST

94.83	12032	2.96	2297	14.94	3rd Gear(A3)	.....	183	59	74	28.990
103.64	9279	4.19	2200	9.65	5th Gear(B1)	.....	186	52	66	28.880
103.54	7657	5.07	2198	7.60	6th Gear(C1)	.....	185	54	68	28.880
107.63	7388	5.46	2200	7.17	7th Gear(B2)	.....	187	55	69	28.800
108.46	6185	6.58	2201	5.81	8th Gear(C2)	.....	186	56	71	28.860
108.44	5597	7.27	2200	5.08	9th Gear(B3)	.....	188	58	75	28.860

VARYING DRAWBAR PULL AND TRAVEL SPEED WITH BALLAST—7 G(B2)

Pounds pull	7388	8053	8605	8998	8843	7553
Horsepower	107.63	104.29	98.92	89.93	75.53	54.59
Crankshaft speed rpm	2200	1970	1764	1546	1319	1097
Miles per hour	5.46	4.86	4.31	3.75	3.20	2.71
Slip of drivers %	7.17	7.87	8.70	9.52	9.25	7.60

TRACTOR SOUND LEVEL (with Sound-Gard cab) dB(A)

Maximum available power 2 hours	82.5
75% of pull at max. power 10 hours	82.5
50% of pull at max. power 2 hours	82.0
50% of pull at reduced engine speed 2 hours	82.0
Bystander 16th gear (D4)	87.5

TIRES, BALLAST AND WEIGHT

		With Ballast	Without Ballast
Rear tires	—No., size, ply & psi	Two 18.4-38;8;20	Two 18.4-38;8;20
Ballast	—Liquid	1085 lb each	None
	Cast iron	750 lb each	None
Front tires	—No., size, ply & psi	Two 11L-15;6;28	Two 11L-15;6;28
Ballast	—Liquid	None	None
	Cast iron	20 lb each	None
Height of drawbar		20 inches	20½ inches
Static weight with operator—Rear		11640 lb	7970 lb
Front		3420 lb	3380 lb
Total		15060 lb	11350 lb

The University of Nebraska Agricultural Experiment Station
 E. F. Frolik, Dean; H. W. Ottoson, Director; Lincoln, Nebraska

EXPLANATION OF TEST REPORT

GENERAL CONDITIONS

Each tractor is a production model equipped for common usage. Power consuming accessories can be disconnected only when it is convenient for the operator to do so in practice. Additional weight can be added as ballast if the manufacturer regularly supplies it for sale. The static tire loads and the inflation pressures must conform to recommendations in the Tire Standards published by the Society of Automotive Engineers.

PREPARATION FOR PERFORMANCE RUNS

The engine crankcase is drained and refilled with a measured amount of new oil conforming to specifications in the operators manual. The fuel used and the maintenance operations must also conform to the published information delivered with the tractor. The tractor is then limbered-up for 12 hours on drawbar work in accordance with the manufacturer's published recommendations. The manufacturer's representative is present to make appropriate decisions regarding mechanical adjustments.

The tractor is equipped with approximately the amount of added ballast that is used during maximum drawbar tests. Prior to the maximum power run the tire tread-bar height must be at least 65% of new tread height.

POWER TAKE-OFF PERFORMANCE

Maximum Power and Fuel Consumption. The manufacturer's representative makes carburetor, fuel pump, ignition and governor control settings which remain unchanged throughout all subsequent runs. The governor and the manually operated governor control lever is set to provide the high-idle speed specified by the manufacturer for maximum power. Maximum power is measured by connecting the power take-off to a dynamometer. The dynamometer load is then gradually increased until the engine is operating at the rated speed specified by the manufacturer for maximum power. The corresponding fuel consumption is measured.

Varying Power and Fuel Consumption. Six different horsepower levels are used to show corresponding fuel consumption rates and how the governor causes the engine to react to the following changes in dynamometer load: 85% of the dynamometer torque at maximum power; minimum dynamometer torque, $\frac{1}{2}$ of the 85% torque; maximum power, $\frac{1}{4}$ and $\frac{3}{4}$ of the 85% torque. Since a tractor is generally subjected to varying loads the average of the results in this test serve well for predicting the fuel consumption of a tractor in general usage.

DRAWBAR PERFORMANCE

All engine adjustments are the same as those used in the belt or power take-off tests.

Varying Power and Fuel Consumption With Ballast. The varying power runs are made to show the effect of speed-control devices (engine, governor, automatic transmission, etc.) on horsepower, speed and fuel consumption. These runs are made around the entire test course which has two 180 degree turns with a minimum radius of 50 feet. The drawbar pull is set at 4 different runs as follows: (1) as near to the pull at maximum power as

possible and still have the tractor maintain the travel speed at maximum horsepower on the straight sections of the test course; (2) 75% of the pull at maximum power; (3) 50% of the pull at maximum power; and (4) maintaining the same load and travel speed as in (3) by shifting to a higher gear and reducing the engine rpm.

Maximum Power with Ballast. Maximum power is measured on straight level sections of the test course. Data are shown for not more than 6 different gears or travel speeds. Some gears or travel speeds may be omitted because of high slippage of the traction members or because the travel speed may exceed the safe limit for the test course. The manufacturer's representative has the option of selecting one gear or speed over eight miles per hour. The maximum safe speed for the Nebraska Test Course has been set at 15 miles per hour. The slippage limits have been set at 15% and 7% for pneumatic tires and steel tracks or lugs, respectively. Higher slippage gives widely varying results.

Varying Drawbar Pull and Travel Speed with Ballast. Travel speeds corresponding to drawbar pulls beyond the maximum power range are obtained to show the "lugging ability" of the tractor. The run starts with the pull at maximum power; then additional drawbar pull is applied to cause decreasing speeds. The run is ended by one of three conditions: (1) maximum pull is obtained, (2) the maximum slippage limit is reached, or (3) some other operating limit is reached.

SOUND MEASUREMENT

Sound is recorded during each of the Varying Power and Fuel Consumption runs as the tractor travels on a straight section of the test course. The dB(A) sound level is obtained with the microphone located near the right ear of the operator. Bystander sound readings are taken with the microphone placed 25 feet from the line of travel of the tractor.

An increase of 10 dB(A) will approximately double the loudness to the human ear.

For additional information about the Nebraska Tractor Tests write to the Department of Agricultural Engineering, University of Nebraska, Lincoln, Nebraska 68503.



JOHN DEERE 4430 QUAD-RANGE DIESEL